

CHAPTER 13

MATERIALS-HANDLING EQUIPMENT

To keep the Navy supplied with the huge volume of material it needs, many types of handling equipment have been designed to haul, unload, stow, and issue this material. It is important for you to remember that whether the job is handling or stowing material, a piece of equipment is usually available for the job. Any piece of materials handling equipment is only as efficient as the person operating it. If the equipment is not used for the job for which it was built, efficiency is lost.

Throughout your Navy career, you may be required to operate or supervise an operation using materials-handling equipment. Therefore, you should be familiar with the types of materials-handling equipment commonly used at naval activities. *Storage and Materials Handling*, DOD 4145.19-R-1; *Naval Ships' Technical Manual*, chapter 572; *Storage and Materials Handling*, NAVSUP P-284; and the Navy Supplement, NAVSUP P-284-1, give detailed information about materials-handling equipment.

TYPES OF MATERIALS-HANDLING EQUIPMENT

Descriptions and uses of handling equipment normally found in supply operations are contained in the paragraphs that follow.

FORKLIFT TRUCK

The forklift truck is the most widely used powerdriven piece of handling equipment used by the supply department. It is designed to pickup, carry, and stack palletized unit loads of supplies and equipment. Standard forklift trucks are available with lifting capacities of 2,000 to 15,000 pounds and lifting heights of 100 to 210 inches.

Forklift trucks are equipped with telescopic masts that permit loads to be lifted beyond the height of the collapsed mast. Most trucks have free lift, which is the height to which the forks can be raised before the inner slides move upward from the mast and increase the overall height.

Gasoline-powered forklift trucks may be equipped with solid rubber or semisolid tires for use in warehouses, or with pneumatic tires for use in outdoor

storage areas. Electric-powered forklift trucks are equipped with solid rubber or semisolid tires for indoor Operations only.

Forklift trucks are generally used in the handling of palletized unit load. They may also be used for hauling boxes or containers equipped with skids and other large rigid containers or packages. They are used aboard ship, on barges, on piers, in warehouses in freight terminals, and on the ground to hoist heavy containers. [n yards which are not covered with hard surfaces, the bucks must be equipped with pneumatic tires in order to operate efficiently.

While forklift trucks may occasionally be used in place of tractors, their greatest efficiency is obtained in their use for elevating palletized loads into storage and for handling palletized loads between hauling operations. They should not travel with individual loads for distances of more than 400 feet. If the operation requires longer travel, the trucks should be supplemented by tractor-trailer trains or other materials handling equipment. Personnel should use a forklift truck at each end of the haul for loading, unloading, and stacking. A 15,000-pound, pneumatic the, forklift truck is shown in figure 13-1.

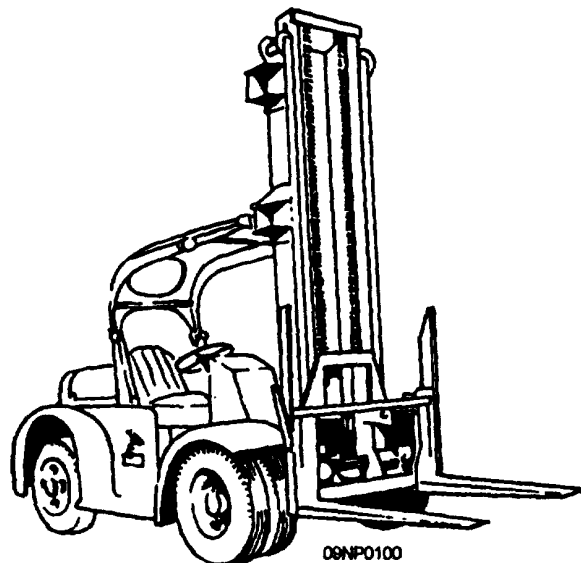


Figure 13-1.-Forklift truck.

TRACTOR-TRAILER TRAINS

The tractor-trailer train (figure 13-2) is a system of hauling with a self-propelled motor power unit connected to a series of individual load-carrying trailers.

Different types of tractors and trailers are used. Tractor-trailer trains can haul larger loads than carrier-type trucks of equal horsepower capacity. They can be operated in trains up to the total drawbar pull of the tractor. The number of trailers one tractor can keep in operation depends upon conditions such as length of haul, nature of material, and weight of the load on each trailer. Under normal conditions, one tractor should be able to keep one set of hailleurs loading, a second set underway, and a third set unloading. Tractor-trailer trains may be effectively used on hauls between 400 feet and 1 mile in length. A carrier-type truck is normally used for hauls greater than 1 mile.

WAREHOUSE TRACTORS

A warehouse tractor is an electric-or gasoline-powered vehicle designed to pull a train of warehouse trailers. The gasoline-powered models most used in the Navy are equipped with pneumatic tires and have rated drawbar pulls of 2,600, 4,000, or 7,500 pounds. Electric-powered models are equipped with solid rubber tires and have rated drawbar pulls of 2,000 or 4,000 pounds. Drawbar pull, the force that the tractor can exert in pushing or pulling loads, is merely a means of indicating tractor capability. The actual capacity of the tractor is normally far in excess of the drawbar pull rating. A tractor with a drawbar pull of 2,600 pounds

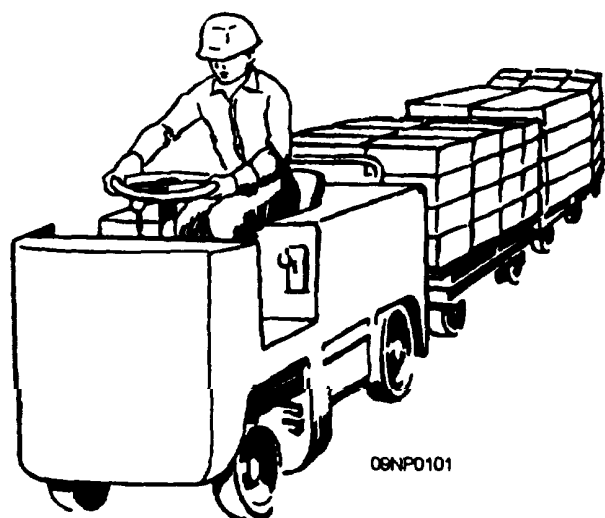


Figure 13-2.—Tractor-trailer train

may, for example, have an actual towing capacity of 50 tons. These are five different models of tractors that are standard for the military services.

WAREHOUSE TRAILERS

A warehouse trailer is a load-carrying platform mounted on casters or wheels. Standard trailers are available in a wide variety of sizes and capacities. Some are equipped with solid rubber or pneumatic tires. The caster-steering type has fixed rear wheels that carry about two-thirds of the load, and caster wheels at the front through which steering is accomplished. The caster-steering type of trailer is produced in 4,000 and 6,000-pound capacities.

HAND TRUCKS

Handtrucks may be constructed of wood or metal. They are used in phases that mechanical equipment cannot be operated because of space limitations,

The four-wheel platform handtruck (figure 13-3) may be used to advantage in breaking out retail issues for bins, carrying light loads, or for any operation involving short hauls with frequent stops. It may also be used in multistory warehouses and for small-lot stockpicking. The truck may be equipped with solid rubber tires or steel wheels.

The two-wheel handtruck (figure 13-4) consists of two handles a platform on which the load rests, and wheels attached to the bottom of the framework. A blade extends at an angle from the bottom of the platform to hold the load.

A stockpicker truck (figure 13-5) is a handtruck used for picking stock from shelves when filling orders. The Storekeeper pushes the truck in the aisles between the shelves to carry small issues in cardboard containers, paper envelopes, or tote boxes. Some

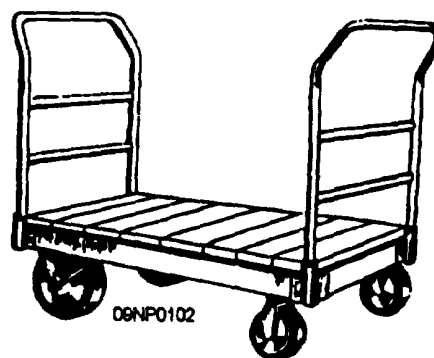


Figure 13-3.—Handtruck, four-wheel.

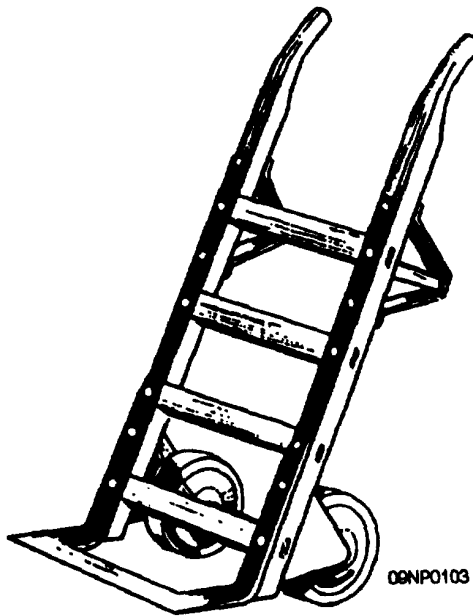


Figure 13-4.-Handtruck two-wheel.

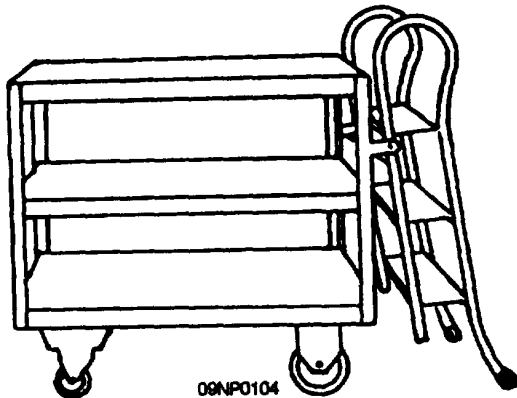


Figure 13-5.-Truck, stockpicker.

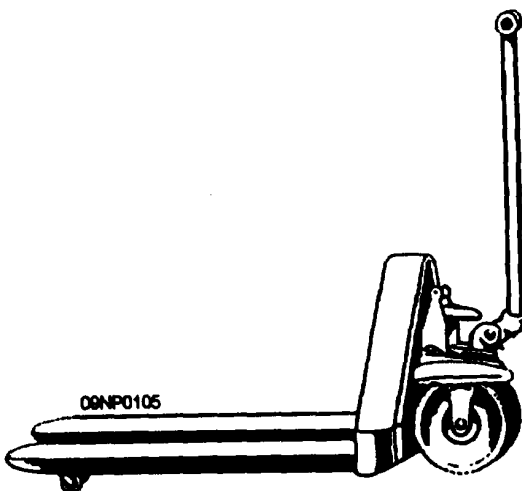


Figure 13-6.—Hand pallet truck, manual/hydraulic.

models are equipped with a ladder so the stockpicker can reach materials on high shelves safely.

HAND PALLET TRUCK

The hand pallet truck is available in the hand/hydraulic model and the electric model. The truck is equipped with two load-carrying forks that can be raised about 4 inches to carry Palletized loads. It is used to move pallet loads that do not have to be tiered and where only short hauls are required. It may be used for the movement of pallet loads in boxcars or into trucks. They may also be used for in-process movements during tipping and receiving operations. They work well in conjunction with forklift trucks and can be operated where a forklift cannot because of space limitations.

The manual/hydraulic model (figure 13-6) is used whenever the operating conditions do not require a handtruck with the special characteristics of the powered model. It may be used to advantage in the loading of boxcars, trucks, and aircraft.

The electric model (figure 13-7) is used when the distance the load is to be moved, the size of the load, the presence of grades or inclines along the route, or other considerations require the use of powered equipment.

TIERING TRUCK

The tiering truck (figure 13-8) is an electric-powered forklift truck of the straddle-arm design. The forks on the tiering truck are located between two outriggers, or straddle arms. The tiering truck is more maneuverable than the standard forklift truck and can generally operate in 6-foot aisles. The standard tiering truck for the military services is the

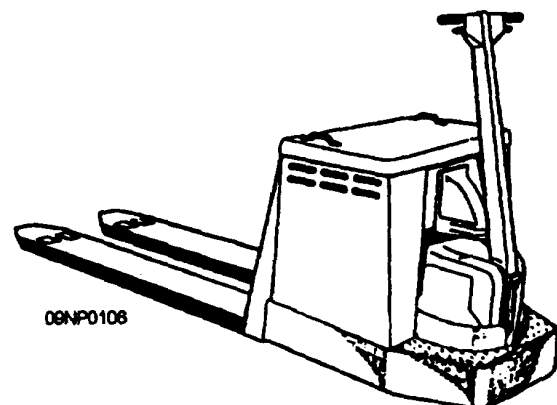


Figure 13-7.-Hand pallet truck, electric.

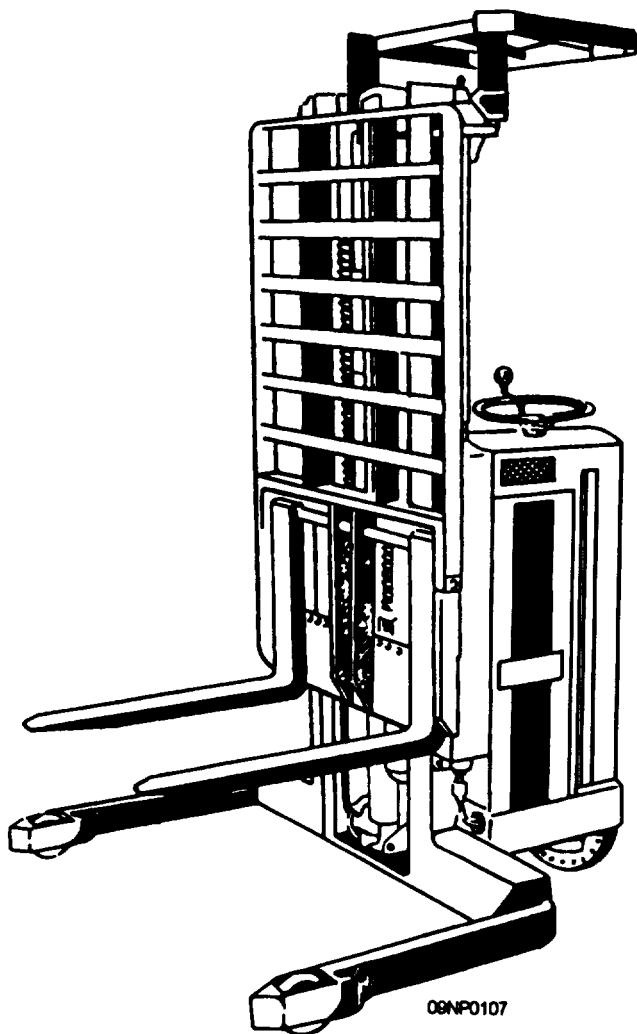


Figure 13-8.-Tiering truck.

electric-powered type that has a load capacity of 4,000 pounds and a lifting height of 68 to 150 inches.

STRADDLE TRUCK

The straddle truck is a diesel- or gasoline-powered four-wheel vehicle designed to straddle, pick up, and transport loads of long and heavy supplies such as pipe, lumber, and steel. The straddle truck (figure 13-9) is used as an efficient conveyance for intrastation movement of palletized material at many supply activities. Straddle trucks offer a faster and more efficient method of moving unitized pallet loads over intermediate distances than the tractor-trailer train.

PALLET SLING

The pallet sling (figure 13-10) is used to handle a palletized load for overhead lifting by a crane or ship's boom. Slings are normally made of cable, but line or

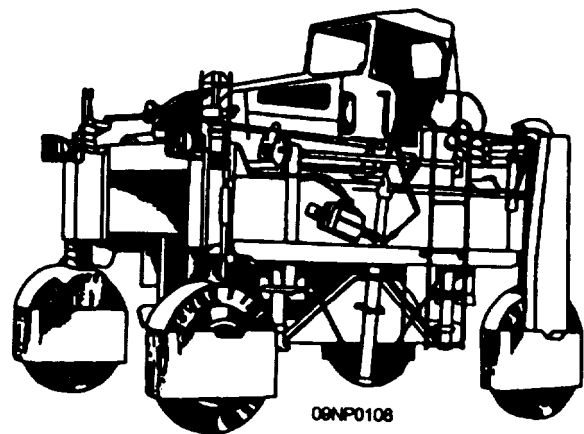


Figure 13-9.-Straddle truck.

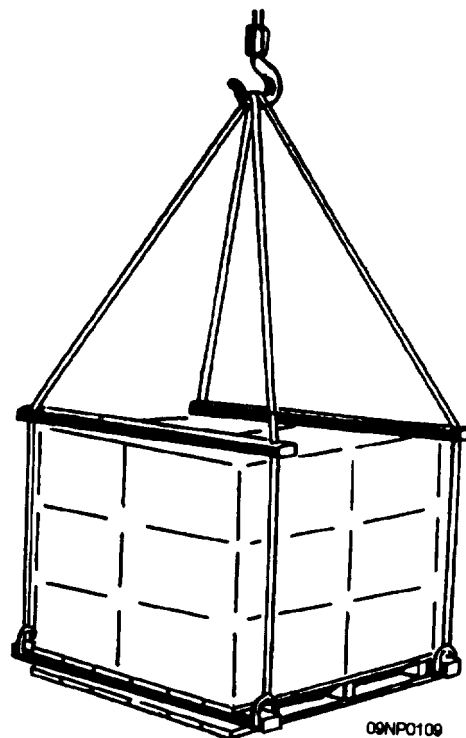
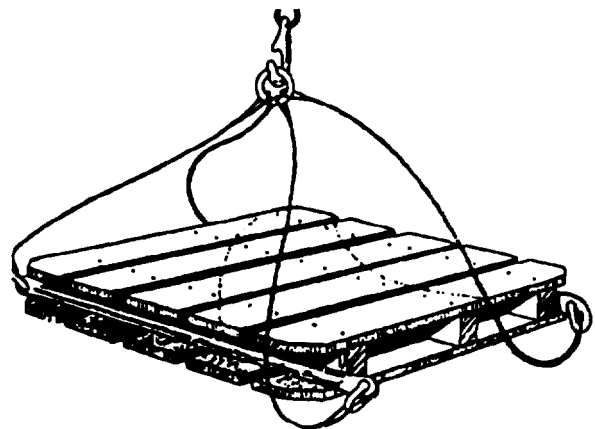


Figure 13-10.—Pallet slings.

chain may be used depending on the weight of material to be lifted.

Slings have rigid horizontal supports at the base. Usually made of steel bars or pipes that must be of sufficient strength to distribute the load across the entire length.

Some slings have movable spreader bars at the top to prevent the load from being crushed when lifted.

PALLETS

A pallet is a wooden, steel, or aluminum platform on which supplies are loaded, transported, or stored in units. Use of pallets permits handling the material with forklift trucks, cranes, and other transporting equipment.

The standard pallet is a 40- by 48-inch platform that accommodates most packages and stores in warehouses. It is regarded as the general-purpose pallet. General-purpose pallets may be either the flat type or box type. Flat Pallets may be single-faced or double-faced. Single-faced pallets (figure 13-11) have one platform nailed or bolted to stringers, usually made of 2- by 4-inch material. A double-faced pallet (figure 13-10) has platforms on the top and the bottom of the stringers and is excellent for stevedoring and transit-shed operations.

The box-type pallet, illustrated in figure 13-12, is used for handling small-lot items or easily crushed

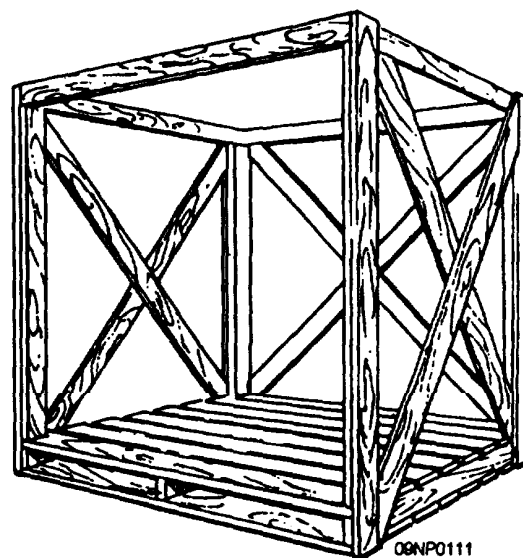


Figure 13-12.—Box pallet.

cargo. When discharging items from a ship to a transit shed, loading directly into a box pallet saves considerable time and labor.

Nestable sheet metal pallets are convenient for three reasons (1) the maintenance cost is low, (2) they save storage space, and (3) you have no problem keeping them sanitary. Figure 13-13 shows a few single-faced pallets stowed alongside a stack of sheet-metal pallets. As you can see, the saving in storage space is tremendous.

Lightweight aluminum pallets also are used, but are expensive and difficult to repair.

In addition to the standard pallet there is a 48- by 72-inch stevedoring pallet, which is used primarily for transporting and storing drummed products and for stevedoring purposes. Pallet construction and illustrations on the stevedore pallet can be found in NAVSUP P-284-1.

Loading Pallets

When a pallet is loaded, three things must be considered: (1) maximum load, (2) stability, and (3) proper pallet size. The pallet must pass through all doors, aisles, and hatches likely to be encountered. The stability of the material on the pallet must be considered and a decision made as to the type of pallet to use.

Figure 13-14 shows the recommended way to load material on a pallet. The size of the boxes being loaded will determine their arrangement on the pallet. A standard loading pattern is not always appropriate.

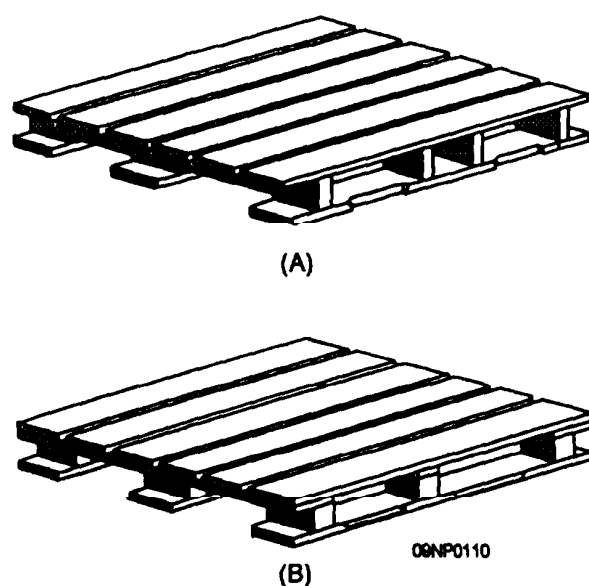


Figure 13-11.—Pallet, x 48-inches, four-way entry: (A) Partial stringers (B) Post construction.

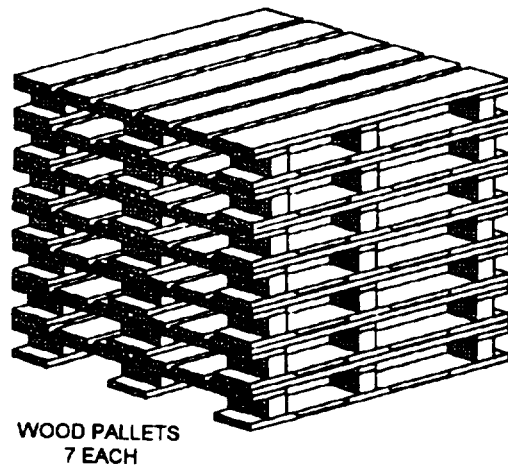
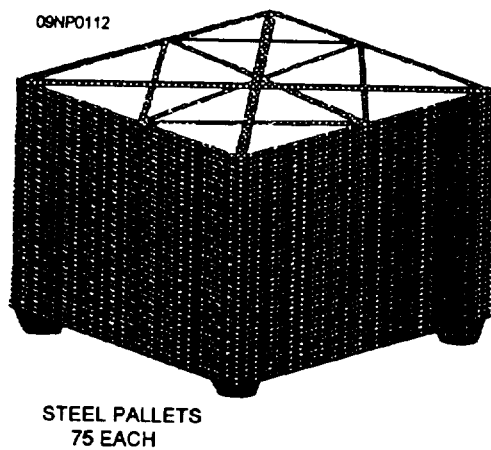


Figure 13-1.—Stowage space of wooden and sheet metal pallets compared.

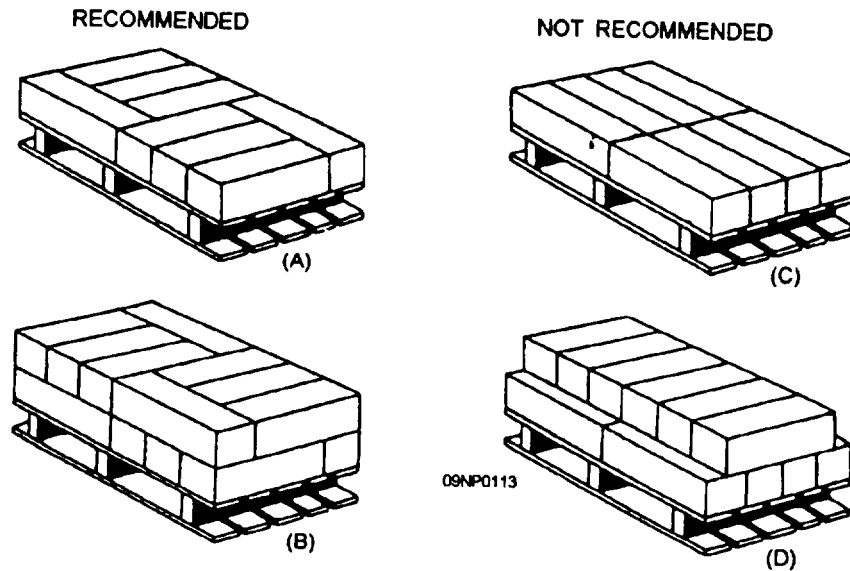


Figure 13-14.—Best way to load a pallet.

However, in the illustration you can see that the material not only fits the pallet, as recommended in A and B stacking, but is arranged so as to provide stability against slipping or sliding.

Boxes of materials are not always the same size. When this is true, place the highest and strongest cases at each end of the pallet and the smaller and more fragile cases in the center. This arrangement provides a stronger surface for a second tier of cases on the pallet and also makes it possible to place a second loaded pallet on top for storage.

When you palletize round items, such as gas cylinders, use specially constructed notched spacers or collars as shown in figure 13-15.

Palletized material that must be moved several times should be strapped. Metal or nylon strapping may be used; the number of straps required for a palletized unit depends upon the kind of handling it is to receive.

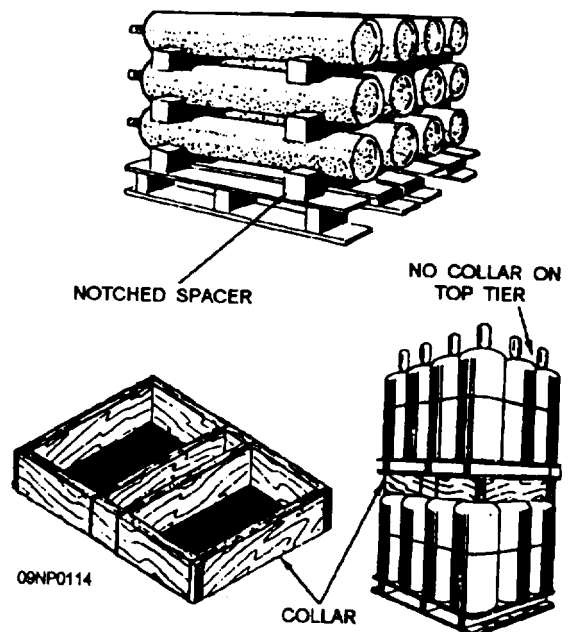


Figure 13-15.—Palletized gas cylinders.

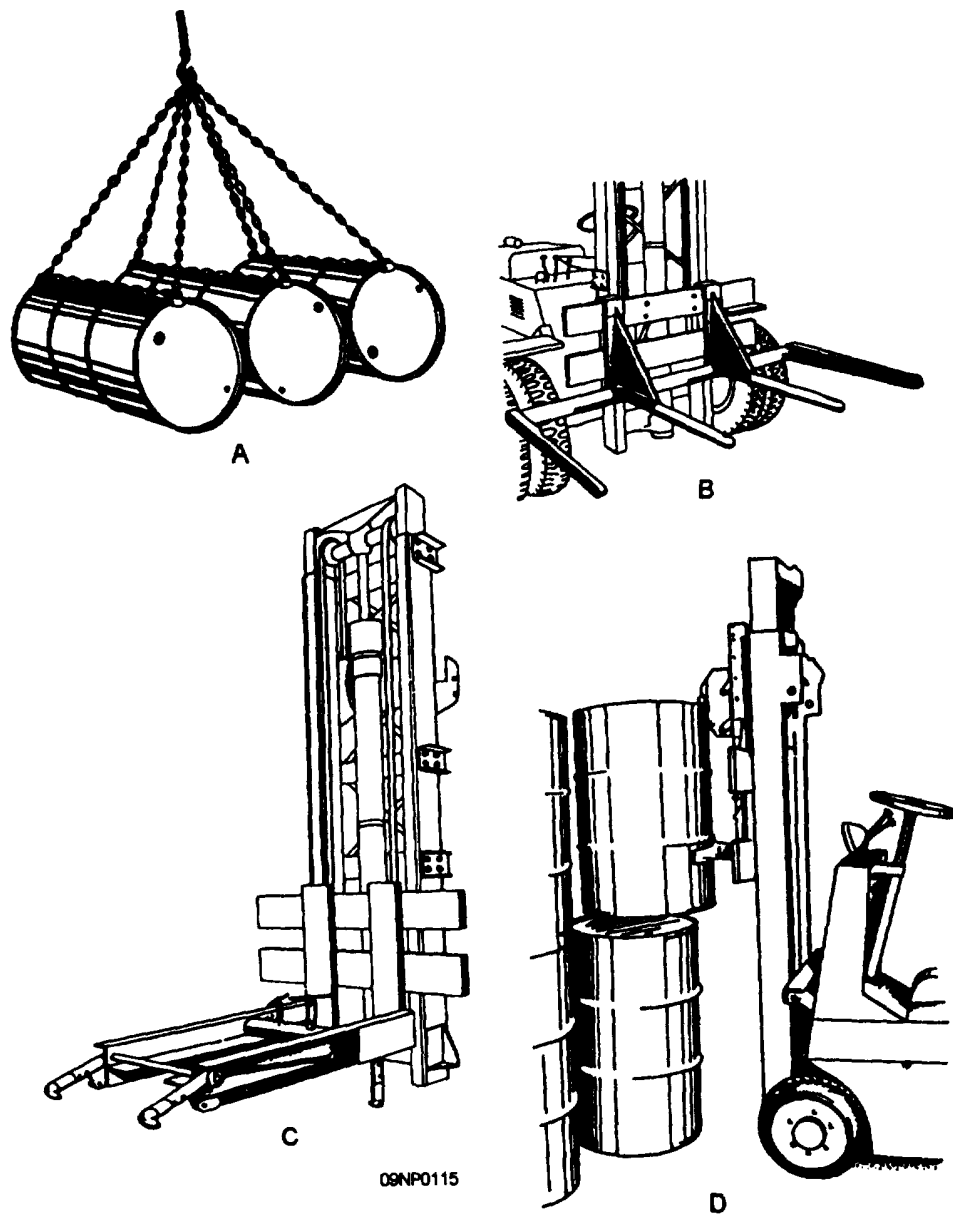


Figure 13-16.—Drum-handling equipment: (A) Sling; (B) Cradle attachment; (C) Horizontal carry attachment; (D) Vertical carry attachment.

The tool used to tighten the strapping is capable of exerting a great amount of force. Therefore you must be careful not to crush the material. Metal or folded cardboard corners may be placed under the strapping to distribute the force over a wider area and help prevent damage to the cartons or their contents.

DRUM-HANDLING EQUIPMENT

The drum-handling sling is a device for picking up drums or barrels. It was designed for shipboard loading, but may be used with a crane for any drum or barrel handling operation. The sling may be of the chain type

(figure 13-16A), which is a series of chain loops and sliding hooks. It may also be of the frame type, which is a steel bar from which a series of sling hooks are suspended.

Other drum-handling equipment in use includes several forklift truck attachments capable of handling filled 55-gallon drums. Four such attachments are available. The first consists of a series of specially shaped and spaced forks that cradle the drums to be handled. (See figure 13- 16 B.) Normally this attachment is fabricated to handle three filled drums at one time. The second type of attachment, which is mounted on the regular truck forks, consists of side rails

from which specially designed hooks are suspended at front and rear (figure 13-16C). The attachment is lowered over the drums until the hooks drop into position over the drum rims. This attachment handles two filled drums at one time. The third type of attachment, which is vertically operated, handles one filled drum at a time. (See figure 13-16 D.) The fourth type of drum-handling attachment operates on the principle of vacuum. This attachment is not in wide use. This is because of the expense involved in the installation of this attachment and the fact that once installed the use of the forklift truck is restricted to drum handling only.

CARGO NET SLING

The cargo net sling (figure 13-17) is made of nylon straps cargo together in a crisscross pattern to form a 12 foot square or 14 foot square net. The four corners of the net have steel rings sewn in for the pickup hoist hooks or lines used to form an apex. In this type of sling no bars are used as supports. The idea being that the net closes about the material being lifted.

Cargo net slings are generally used aboard Combat Logistics Force (CLF) ships for underway replenishment (UNREP) operations support. Pallets of cargo can be placed in the net and transferred with a minimum of loss. Some ships use cargo net slings for handling miscellaneous cargo that is placed directly into the net as shown in figure 13-17.

ROLLERS, CONVEYORS, AND CHUTES

Conditions may be such that rollers conveyors, or chutes are more effective than mobile equipment or may supplement mobile equipment when a deficiency of mobile equipment exists.

Rollers

Hardwood rollers or pipes may be placed under heavy boxes or skids so that they may be moved about in a storeroom or vehicle. Two or more rollers are used, depending on the weight of the box. The end of the box toward the direction in which the box is to be moved is raised by a hoist, lever, or other lifting device, and a roller is placed under it. The box is then pushed forward as more rollers are placed in front of it. As the box passes off a roller, the roller is picked up and placed in front of the box.

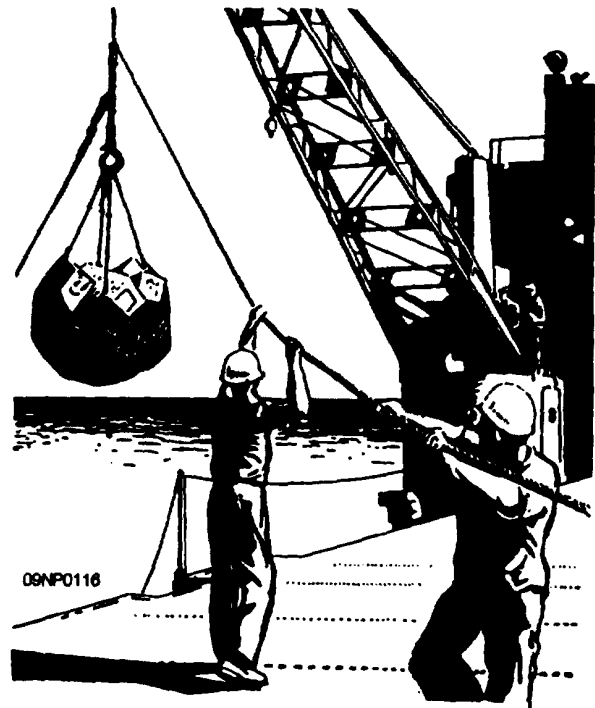


Figure 13-17.—Cargo net sling.

Conveyors

A conveyor is a device for moving supplies in a fixed line of travel. Two basic types of conveyors have been adopted as standard for the military departments, the powerdriven belt conveyor and the gravity-type roller or wheel conveyor.

The power-driven belt conveyor consists of an endless belt mounted on a frame and driven by a pulley connected to a drive motor. The belt travels over a series of rollers or a sliding bed. The belt conveyor can be used to transport materials over a fixed path of travel up inclines of as much as 25 degrees.

The roller conveyor can be installed with one end lower than the other to take advantage of gravity. It can also be installed level and the load pushed along manually. Several sections can be put together and developed into a continuous system for movement of material. The conveyor can be used on piers, in storerooms, or wherever a steady flow of supplies is desired. A drop of one-half inch per foot is usually required to keep an object in motion on the rollers. Figure 13-18 shows their use in clearing the landing area of the receiving ship during underway replenishment. Folding stands may be used when it is necessary to clear obstructions on the deck or to pass through doors. Accessories for horizontal conveyors include turntables and curved sections.

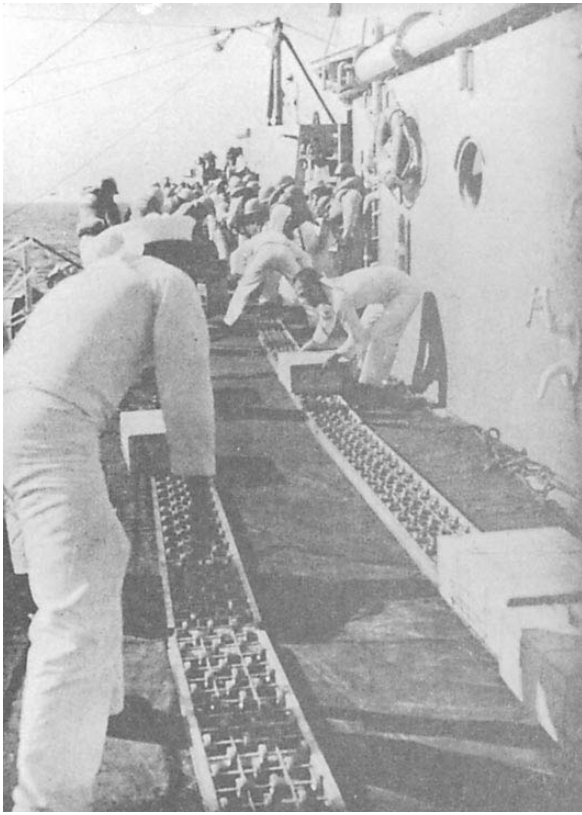


Figure 13-18.-Horizontal conveyors.

Roller conveyors with hinged gate actions are also available for warehouse operations involving the crossing of thoroughfares. (See figure 13-19.) If a roller conveyor is used, the cargo should be moved slowly enough to permit personnel at the end of the conveyor to handle the boxes. A brake may be improvised using a belt as shown in figure 13-20.

Chutes

The chute (figure 13-21) provides a rapid means of conveying packages downward. The principal application is aboard ships where a need exists to strike down stems.

CRANE

A warehouse crane is a power-driven, self-propelled unit consisting of a boom mounted on a mobile wheeled chassis. The boom can be operated independently so that sluing and topping can be accomplished without movement of the chassis. Power is supplied by a gasoline engine or by electric motors. Gasoline-powered cranes (figure 13-22) are equipped with pneumatic tires for outdoor operation. have 180 or 360 degree sluing booms, and have capacities of 6,000, 10,000, or 20,000 pounds. Electric-powered

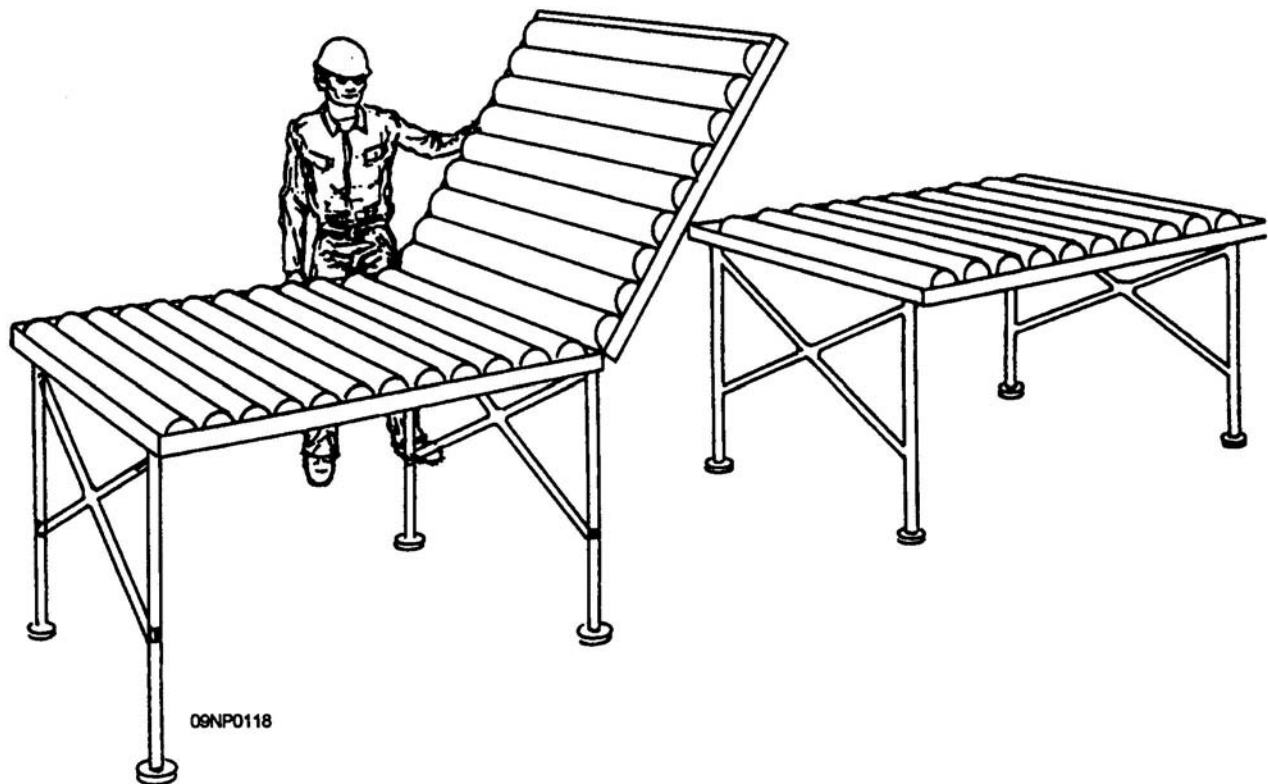


Figure 13-19.—Roller conveyor hinged gate multiphase warehouse operation.

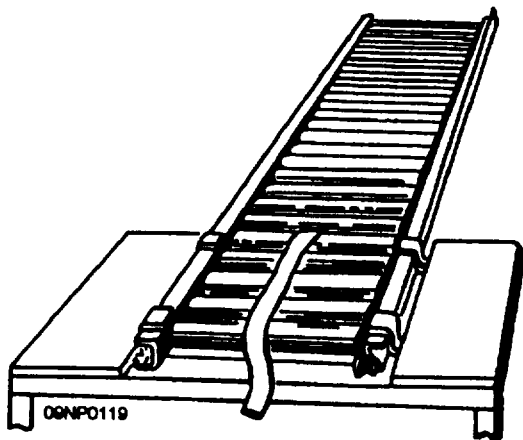


Figure 13-20. Brake on a roller conveyor.

cranes are equipped with solid rubber tires for indoor operations. They have 270 degree sluing booms and have a capacity of 6,000 or 10,000 pounds.

The mobile crane consists of a boom mounted on a truck chassis and has characteristics similar to that of a warehouse crane. However, the mobile crane has a greater topping distance and is, therefore, used in a wide range of operations.

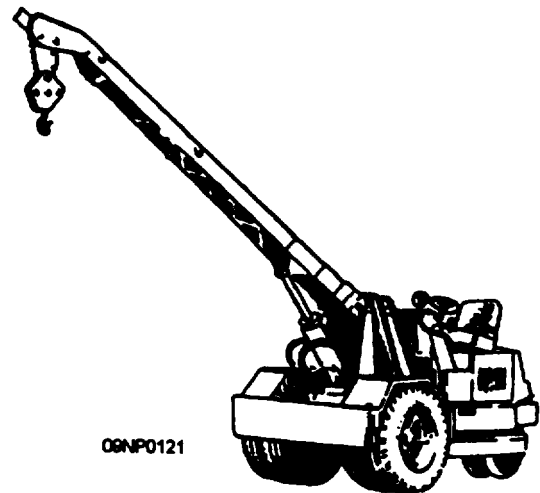


Figure 13-22.— Warehouse crane, gasoline-powered.

The gantry crane is a hoisting unit mounted on a gantry (any frame or structure spanning or bridging an intervening space). Gantries may be arched, bridged, full, or half.

The unit shown in figure 13-23 is an adaptation of the overhead type of crane applied to outdoor service where no permanent elevated structure exists on which

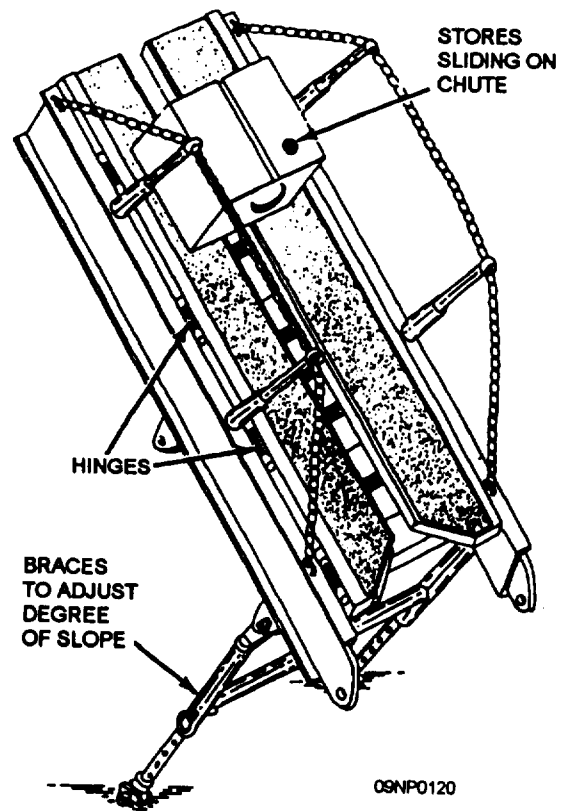
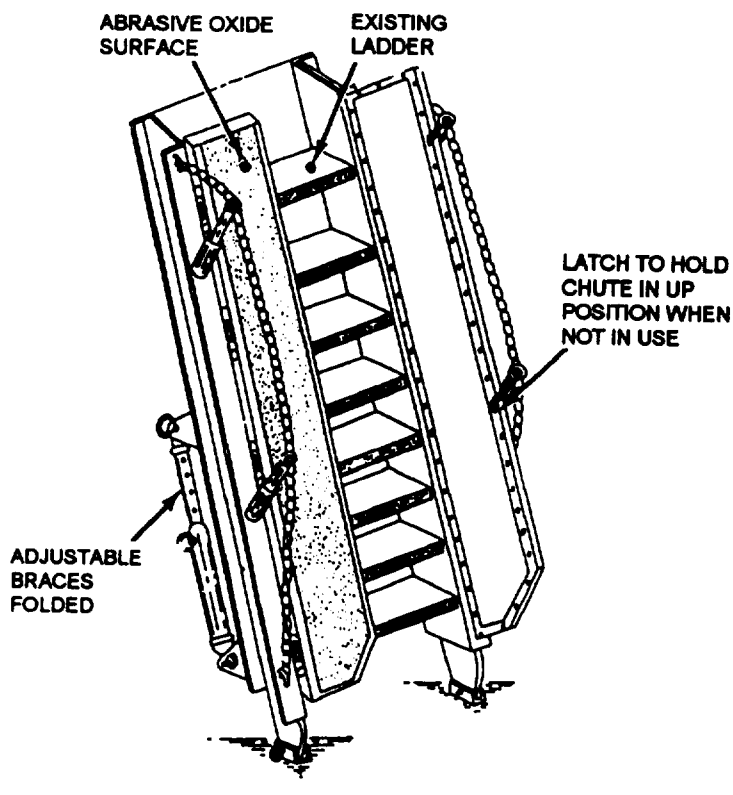


Figure 13-21. Stores strike-down chute.

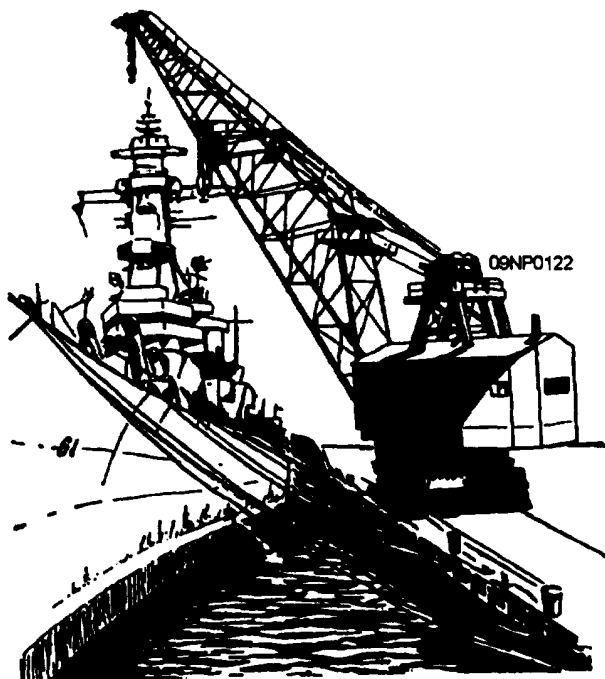


Figure 13-23.-Crane, gantry.

to install a crane. The crane bridge is mounted on trestles having legs which are generally constructed with wheel trucks for operating on tracks. Such cranes are referred to as portable gantry cranes.

If the trestles rest directly on the ground or footings, the term “fixed gantry crane” is applied. This type of crane is built especially for particular locations. It has been constructed with a span of 200 or more feet. The gantry may have a trolley running on the bridge carrying a hoist. This is the most common form and is what is meant by gantry crane. However, the gantry may have a stiff-legged derrick, a rotating pillar, a job crane, or a hammerhead crane mounted on its bridge as auxiliary equipment.

Because this type of crane spans the area over which it operates, it has been particularly useful in shipbuilding, in storage yards, and at docks for handling bulk material.

A wharf crane (figure 13-24) is located on and generally is a part of the wharf or pier structure. It is particularly adapted to the transfer of Cargo between the wharf or pier and a vessel.

HOISTS, PULLEYS, AND DOLLIES

Various types of hoists, pulleys, and dollies are available aboard air stations and ships for moving equipment and supplies. The SK should be acquainted

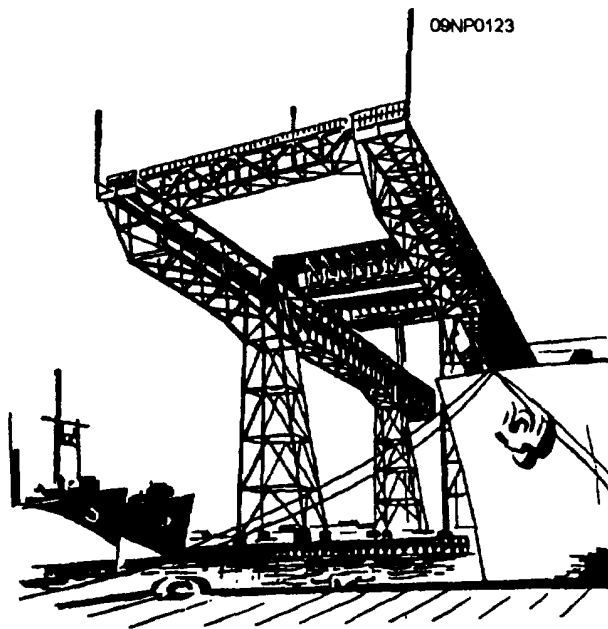


Figure 13-24.-Crane, wharf.

with this equipment and its purpose so that as various situations arise, the SK will be able to select and use the necessary piece of equipment.

Hoists

Chain hoists or chain falls provide a convenient and efficient method for hoisting loads by hand. The chief advantages of chain hoists are that one person can raise a load of several tons, and the load can remain stationary without being secured. Manually operated chain hoists of the type illustrated in figure 13-25 can be carried and operated by one person. They are particularly useful in trucks and small storerooms aboard ship and when other more mechanized equipment is not available.

Some larger storerooms are equipped with electrically operated hoists which move along overhead trucks. These hoists have the advantages of speed and ease of operation.

Block and Tackle

A block and tackle (figure 13-26) is an arrangement of one or more pulleys with rope or cable for pulling or hoisting large, heavy objects. The block and tackle (also called tackle or pulley) is used in the same situations as the chain hoist for smaller loads.

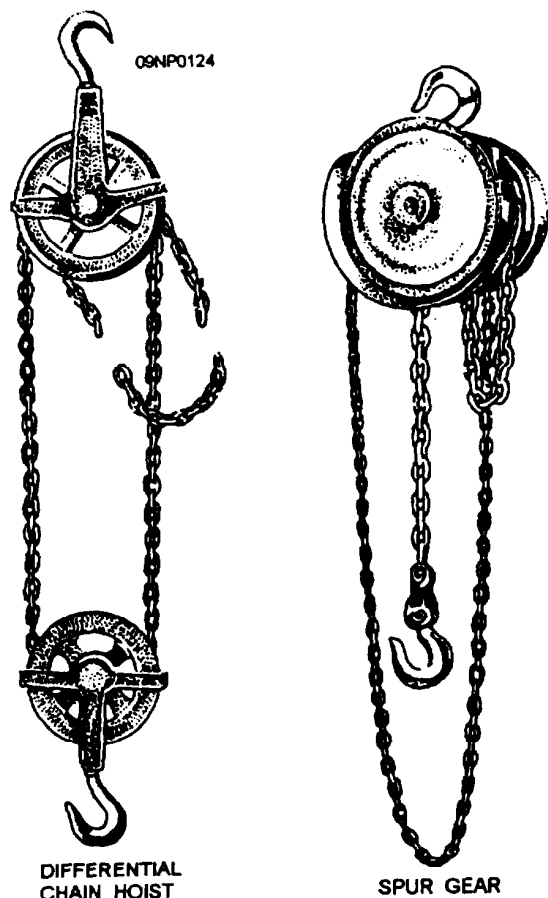


Figure 13-25.—Chain hoists.

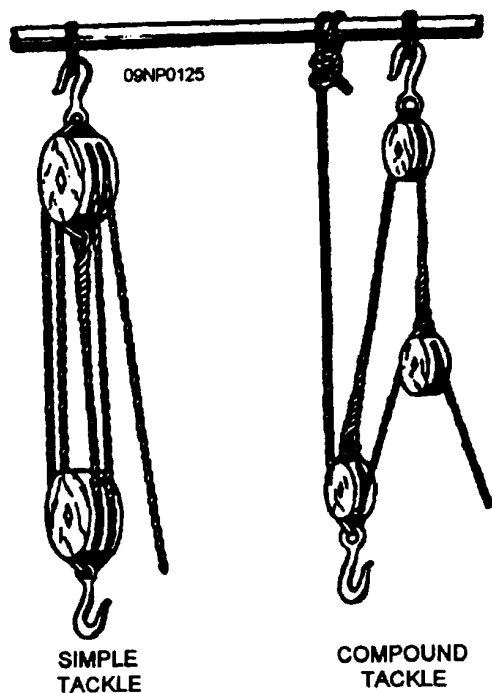


Figure 13-26.—Block and tackle.

Dollies

The dolly or dolly truck is a frame mounted on wheels or rollers and is used for moving or shifting heavy loads for short distances. Figure 13-27 illustrates the three common types used by the Navy.

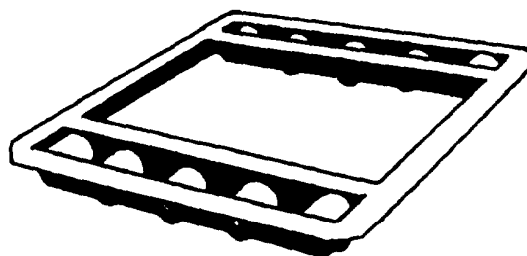
The general-purpose dolly (figure 13-27A) is used to move unpalletized material, primarily large, bulky, and/or heavy items over short distances.

The pallet dolly (figure 13-27B) with a capacity of 4,000 pounds is used primarily to move palletized loads in and out of boxcars, trucks, trailers, and storerooms.

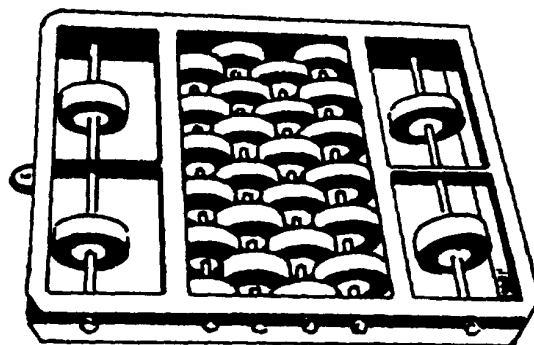
The advantages of the reefer car dolly are maneuverability, ease of operation, and suitability for



(A) DOLLY, GENERAL PURPOSE



(B) DOLLY, PALLET ROLLERS



(C) DOLLY, (REEFER CAR)

Figure 13-27.—Dollies: (A) General purpose; (B) Pallet rollers; and (C) Reefer car.

use on truck and reefer floors. The 24 wheels in the central portion (figure 13-27C) are placed slightly lower than the wheels at the ends. The wheels at the ends are held in position by springs, which allow them to move on their axles as the load is guided to its destination. The difference in height of the center and end wheels permits a certain amount of reeking motion which aids in movement and guidance of the pallet load. That is, the tilting effect allows the dolly to turn, and the center wheels (on offset axles) prevent loading of wheels in slatted floors.

MATERIALS HANDLING ABOARD SHIP

The use of materials-handling equipment aboard ship is dependent upon several factors: type of ship, its physical characteristics, and quantity of material to be moved.

On cargo ships, the primary method of moving material is by cargo booms. These booms may be rigged to provide the required lift capability and to reach the required work area. The most common rig is the "yard and stay" which uses two booms and two winches with the two wire ropes (whips) corrected to a single cargo hook. In loading from or to a pier, one boom is positioned over the hold and the other rigged out so that the head of the boom is over the pier. The load may then be picked up on one boom, transferred to the second by taking in on the second whip while paying out the first whip, and lowered from the second boom.

Figure 13-28 shows a yard and stay rig with a suspended load. Also shown is one type of hatch tent.

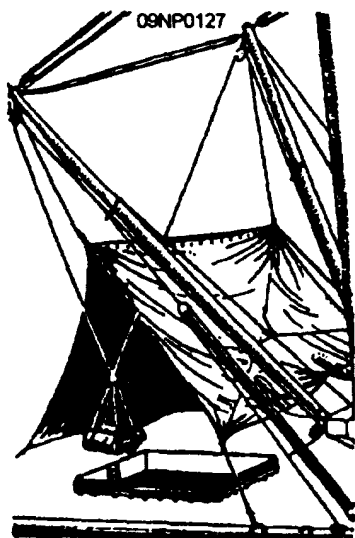


Figure 13-28.-Cargo booms with Seattle hatch tent.

The Seattle hatch tent may be used to protect personnel and cargo in the hold during inclement weather. A hatch tent provides protection not only from rain or snow but also from the sun during very hot weather.

A save-all is a device used to prevent the loss of cargo overboard during loading or discharging operations. The most common type of save-all, (shown in figure 13-29) is a net (rope or nylon) approximately 15 by 20 feet or larger. Wire rope nets and wooden platforms (figure 13-30) may also serve as save-alls. There should be a save-all rigged to each working hatch, and also beneath each brow, skid, or conveyor if the ship is loading or discharging through sideports.

You can rig a save-all by lashing one side of a net even with the bulwark. Then by securing it to cleats on the deck or bulwark, and securing the bottom of the net to the stringer on the pier. Leave enough slack in the save-all to allow for the rise and fall of the tide.

A save-all may be improvised by lashing together several cargo nets. When working light cargo, a tarpaulin may serve as a suitable substitute.

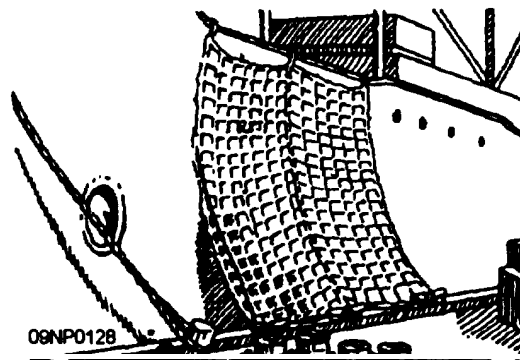


Figure 13-29.—Rope save-all.

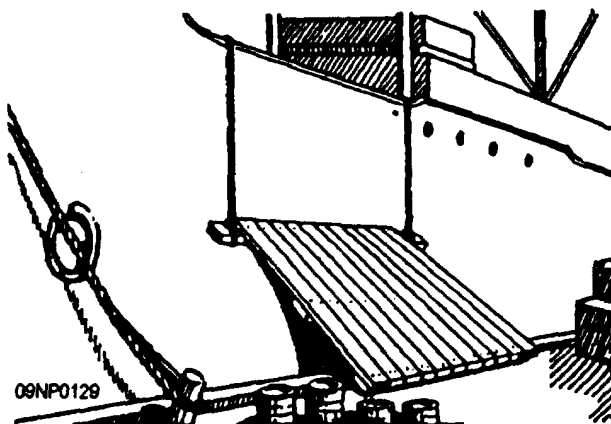


Figure 13-30.—Wooden save-all.

OPERATION AND MAINTENANCE OF MATERIALS-HANDLING EQUIPMENT

The best method for moving stores from one location to another depends upon such factors as: mechanical equipment available, number of personnel available, distance of haul, terrain, required speed of discharge or loading, storage space available, traffic pattern, lighting (if at night), and commodities to be handled. Each problem will be different; however, with careful planning and consideration of the factors that exist, workable solutions can usually be resolved.

OPERATOR QUALIFICATIONS

In order for you to operate materials-handling equipment (MHE), you must possess a valid authorization from the ship or station to which you are assigned.

Ships and stations having MHE should have a training and qualifying program (not covered in this manual). A Storekeeper should seek to qualify for operating the necessary MHE to perform the job. Successful y.

MAINTENANCE RESPONSIBILITY

On board ships, preventive maintenance service is performed on all MHE by the "A" division for mechanical functions and the "E" division for electrical functions. Ashore, these responsibilities rest with the public works department. The operator, however, also has responsibilities.

Included with the operation of a vehicle are certain inspections Required before starting the equipment. The driver's inspection should include checking lights, horn, tire pressure (if pneumatic), oil, gasoline, battery, hydraulic fluid level. They should also ensure that the required tools and safety equipment are present on the vehicle. An authorized mechanic or electrician should be called to repair the equipment before further damage or an accident results if any defects are noted.

SAFETY PRECAUTIONS

Safety precautions must be observed in any cargo-handling operation to keep accidents to a minimum. However, cargo handling aboard ship requires more rigid safety precautions. Warehouses and storage areas ashore are designed and arranged to provide maximum use of materials-handling equipment. This is not usually the case aboard ship.

Working space is much more confined, the use of materials-handling equipment is limited. The ease, speed, and convenience of cargo handling was not the entire consideration when designing the ship.

Safety precautions are published separately for activities ashore and for forces afloat. Those for activities ashore are published under the title of Department of the Navy Safety Precautions for Shore Activities.

Safety precautions for forces afloat are issued by systems commands, bureaus, and offices of the Department of the Navy in the form of publications, pamphlets, periodicals, and directives. The Chief of Naval Operations publishes indexes of all Department of the Navy safety precautions applicable to forces afloat. These indexes are issued as OPNAV notices with the subject classification number 5100.

Safety precautions are something you either know and observe or you do not. There is no middle ground. You cannot learn or use them halfway. Human lives (yours and those of other people working around you) and expensive equipment are at stake. Safety precautions as discussed in this chapter apply not only to the workers but to everybody in the vicinity of potential danger.

A Storekeeper should be aware of and observe safety precautions at all times. The following operating safety rules for materials-handling equipment should be observed:

- Spark-enclosed or explosion proof electric (not gasoline-powered) equipment must be used in areas where gases, flammable liquids, and ordnance material are stored.
- Equipment should be kept free of excessive grease accumulation at all times.
- Special protective equipment should be used when work involves explosives and ammunition.
- Equipment having gas-filled caps with special safety features and with fine mesh screening overexhaust pipe ends should be used.
- Forklift trucks of all types should be equipped with an overhead safety guard or steel. Exceptions are permissible only when the overhead safety guard either would increase the overall height of the forklift truck or prevent the operator from having freedom of movement.

- Equipment should be free of all unauthorized attachments.
- Spilled gasoline should be cleaned up before starting an engine. If flushing is not possible or practical, the approved absorbent material should be used. Metal shovel, metal grid, or other spark-producing tools should not be used in this process. When more than a pint of gasoline has been spilled, a person should stand by with a the extinguisher while the spill is cleaned up.
- A machine which is improperly loaded or which is not in a safe mechanical condition should not be used.
- The engine should be stopped and brakes set before the operator leaves the machine.
- Only licensed operators should be permitted to operate equipment.
- Suitable fire-extinguishing equipment should be available at all times.
- A truck or trailer should not be unloaded unless it is blocked.
- Floorload capacity should not be exceeded.
- Equipment should not be operated in excess of the maximum speed limitations.
- Stacks should not be bumped nor pushed with power-driven equipment.
- Forklift truckss should travel with forks elevated approximately 4 inches above the floor and be parked with the forks resting on the floor.
- Personnel should not be permitted to stand under loads being hoisted or lowered, nor be allowed to ride on equipment.
- Personnel may be hoisted with a forklift only when authorized and then only when a safety pallet is used.
- The load capacity should be prominently stenciled on a forklift truck; do not overload.
- Do not load a forklift truck while it is in motion.
- Tilt the mast back when transporting a load by forklift truck.
- Drive forward when transporting a load up a ramp and in reverse when going down a ramp.

The following paragraphs discuss causes of accidents, some specific danger areas, supervisory

responsibility, and provide a checklist of safety precaution

CAUSES OF ACCIDENTS

Primarily, accidents are caused by people. Equipment may be involved, but people handle the equipment. Most accidents are the result of

- Carelessness,
- Inexperience, and/or
- Wrong attitude.

Carelessness

Some locations are potential danger spots. The lack of alertness may cause accidents resulting in injury or death. People working on piers, weather decks, and in the ship's hold must be constantly on the alert for moving or falling objects. As personnel become familiar with a job, they may try to take "shortcuts; which place themselves and others in danger. Fatigue is another cause of carelessness. As people tire, they are less alert and more likely to cause an accident.

Inexperience

Unless personnel are indoctrinated and experienced in handling a particular piece of equipment, they should not be allowed to use it except under close supervision. Persons who operate cranes, capstans, winches, windlasses and other deck equipment must first get authority from the first lieutenant. A person may know how to drive a forklift, but may not be fully aware of the safety precautions that should be observed while operating it. Operating materials-handling equipment is not the only way that inexperienced personnel may cause accidents. A person working as a cargo handler for the first time may not be aware of the dangers involved. A minor mistake such as an improperly loaded cargo net may result in injury to the operator or someone else.

Attitude

Some people work around dangerous machinery or equipment, explosives, acids, electrical equipment without mishap. They take necessary safety precautions. Others, however, working around dangerous objects or in dangerous work become overfamiliar with the dangers.

They have a tendency to slack off in the practice of safety. The adage there are old electricians and bold

electricians, but there are no old, bold electricians applies equally well to cargo handling. When individuals develop poor attitudes toward their work, a change must be made. Either in attitudes or in work assignments. If previous experience indicates that a person has a tendency toward unreliability, that person should not be permitted to operate materials-handling equipment nor work in a position where the individual's unreliability could result in injury. Of course, the cause of unreliability should be determined and eliminated, if possible.

DANGER AREAS

Many types of accidents can happen when handling cargo. Some of the danger areas and causes of accidents are discussed below:

- **Defective Equipment**—Defective equipment such as winches, rigging, chains, nets, and bridles should not be used. Report their condition to your superior. Repairs should be made only by qualified personnel since a poor repair job may constitute a worse hazard than the defective equipment.
- **Thrown Objects**—Objects such as blocks, crowbars, and slings should not be thrown from the deck into the hold or onto the pier.
- **Improperly Assembled Drafts**—Nets and pallets should be so loaded that items will not fall during hoisting.
- **Failure to Stand Clear**—The warning **STAND CLEAR!** should be given when cargo or hoisting gear is being lowered into a hold or onto the pier.
- **Cargo Improperly Landed**—Cargo should be guided to a safe landing after being stopped about 1 foot above the intended landing area.
- **Loads Stopped Overhead**—The stopping of loads overhead should be avoided. If a hoisted load must be stopped before being lowered into the hold, it should be stopped over the weather deck—never over the square of the hatch nor over the heads of personnel on the pier.
- **Improper Stowage**—When stowed, cargo should be tiered, tied in, stepped back, or floored off to prevent collapse. Dunnage should be used as a firm flooring for tiering. Never stow cargo, even temporarily, in a halfway manner.
- **Hatch Beans or Beads**—When only part of a cargo hatch is open, remaining hatch beans should be pinned or locked in place to prevent

them from being dislodged and falling on personnel below. Hatch boards should be stacked well back from the hatch to prevent them from being accidentally knocked into the hold.

- **Standing in Bight of Line**—Individuals should not stand with their feet in the bight of a line or in the eye of a cargo strip or sling. To do so may result in broken bones or even more serious injury.
- **Fires and Explosions**—Fires and explosions may be caused by: (1) explosive vapor, (2) spilled flammables or explosives, (3) ignition source such as smoking, hot work, open fires, electrical equipment, naked lights, and sparks from tools, (4) heat, (5) spontaneous ignition, (6) water causing chemical reaction with certain substances, (7) improper handling, and (8) inadequate sentries.

Fire is a potential danger with almost all types of cargo. The possibility of fire or explosion is greatly increased when cargo operations involve flammables and ammunition. However, extra precautions are normally taken when these dangerous materials are handled. Probably most fires occur in ordinary combustible material (paper, rags, wood, etc.).

Since the fire hazard is not as great when handling these materials fewer precautions are usually taken and cargo handlers are apt to become careless.

- **Fleet Freight**—Carefully inspect all material received as fleet freight for evidence of damaged or leaking containers. Extremely hazardous conditions can result from several compounds normally used aboard ship.
- **Open Hatches**—Guards should be placed near open hatches and other open spaces. Safety lines must be used around such openings when cargo is not being handled through them.
- **Temporarily Covered Hatches**—Hatches covered only with a tarpaulin or other temporary covering are dangerous, perhaps more so than uncovered hatches, which are fully visible. temporary coverings should be used only during inclement weather, if at all.
- **Riding on Hooks**—Personnel should not be permitted to ride cargo-handling gear, such as hooks or nets, between pier and ship or between the deck and hold. The save-all must not be used as a ladder between the pier and the ship.

- **Removed Handrails**—When handrails are removed to load cargo or for other reasons, the working area should be roped off to prevent personnel from falling over the side.
- **Ladders**—Ladders in the square of the hatch should not be used when cargo is being lowered or hoisted in the hold. Much care must be exercised when using these ladders. Particularly when hatchboards from several decks have been removed. Stairway-type ladders should be used when they are available.
- **Slippery Decks**—Oil, grease, ice, or any slippery material on the deck or pier should be removed immediately or covered with sand, cinders, sawdust, or other suitable antislip material.
- **Improper Lighting**—When concealment is unimportant floodlights should be provided at night on the weather deck, overside, and in cargo holds. Flashlights should be available for emergencies. When entering unlighted compartments, personnel should carry portable safety lights.
- **Asphyxia and Poisoning**—During some cargo handling or related operations, asphyxia or poisoning may result from: (1) lack of oxygen, (2) poisonous gases or fumes, or (3) exposing skin or eyes to or swallowing petroleum products. (Some vapors may be swallowed without the knowledge of the victim.) An individual showing signs of asphyxia or poisoning should receive immediate medical attention and the cargo officer should be notified. The space should be inspected before work is continued.
- **Lifting Cases**—There is a right and a wrong way of picking up heavy cases of material. The correct method of lifting heavy objects is illustrated in figure 13-31. Individuals stand close to the load, with their feet slightly apart and solidly placed. With knees bent, they grasp the object firmly and lift it by straightening their legs, keeping the back as vertical as possible. When lifting from an elevated position, keep the object close to the body.

The square of the hatch should be kept clear and free of debris. Place a solid, level floor of dunnage on top of stowed cargo, when it is needed, to provide sound footing for hold workers or a safe landing area for cargo coming in. Persons in the hold must stand clear of the hatch when a draft is overhead—cargo being hoisted

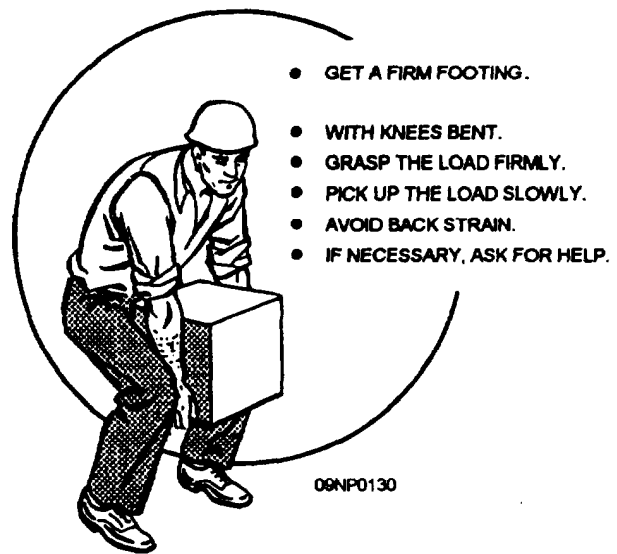


Figure 13-31.-Manual lifting.

from or lowered into the hold. The hold crew should take cover either fore or aft of the square of the hatch.

When a draft is lowered into a hold, it should be stopped approximately 1 foot above its intended landing spot. After the draft has been stopped, the hold crew should then come from under the deck and guide the draft to the desired landing area. Slings or bridles are easily removed from drafts by four crewmen working in pairs. The slings or bridles should be steadied before being hoisted out of the hold. If they are permitted to swing widely during hoisting, they may become entangled in hull fittings or cargo and cause damage to the equipment or cargo or injury to personnel.

You can safely handle small cases on a horizontal conveyor described earlier. For some cargo, you may even substitute finished lumber or waxed dunnage for conveyors. If waking space permits, pallet trucks, pallet jacks, handtrucks, or dollies may be used to move cargo to the storage location.

SUPERVISORY RESPONSIBILITY

If you are in charge of a working party or cargo-handling crew, their safety and proper cargo handling are your responsibility. To prevent injuries to personnel and damage to cargo and ship, all safety precautions must be observed and enforced. Danger is ever present during the handling of any cargo aboard ship.

Through minor accidents or improper handling, cargo-handling equipment or the cargo itself may

become potentially dangerous or unusable without showing visible evidence of damage. If in doubt concerning damage to cargo or safety of equipment, report it to your immediate superior or the cargo officer.

Inspection and maintenance of the pier or wharf are primarily the responsibility of the shore station. However, such defects as bad flooring should be reported. In some cases, temporary repairs must be made to make cargo operations safe.

People may try to use faulty or incorrect cargo-handling equipment and injure themselves or others. Many accidents are caused by pure carelessness. The human factor is always present in accidents, but it can be partially overcome by

- Thorough training in the use of cargohandling equipment
- Instruction in safety
 - Safety precautions to observe
 - Penalties for violations of prescribed safety measures
- Alert supervision

The following is a guide you may use in discharging your responsibility as a supervisor.

- Tell and demonstrate how to work safely.
- Never permit personnel to stand or work under suspended slingloads.
- Tell and demonstrate how to grip slings and bridles.
- See that personnel stand out of the bight, and clear of the throw of the block and hook when using a bull line to move cargo.
- Show personnel how to break down or build piles of Slingloads and safely break out and stow cargo.
- Show your crew how to lift properly.
- See that your crew does not enter dark places (holds, decks, or compartments) without a light.
- Discourage the wearing of rings, gauntlet-type gloves, and trousers with legs so long that they are tripping hazards.
- Ensure that your crew wears safety shoes and helmets while handling cargo.
- Do not permit the use of holders in the square of the hatch when the hoist is moving.

- Ensure your crew's alertness. Have the hold crew take occasional breaks topside for fresh air if necessary.
- Know where to obtain suitable antislip material if the need should arise.
- Know what to do in case of injuries.
- Know the location of fire axes, hose, and other firefighting equipment.
- Know how to remove personnel quickly from the hold should a fire develop or they require medical attention.
- Observe your crew and ensure that they work in a safe manner.

Do not block passageways or openings (doors, hatches, etc.) with cargo, hatch beams, or other material, without permission from the responsible head of department. If a passage must be blocked off, do it in a manner which will enable personnel to regain quick access.

The need for speed in emergency situations or during underway replenishment may outweigh the value of some safety precautions that would ordinarily be taken. However, do not suspend a safety practice unless the degree of urgency warrants it. In all decisions affecting safety, during usual or unusual conditions, there is no substitute for good judgment and experience.

SAFE CARGO-HANDLING PRACTICES

The following list of safety precautions should be observed by all cargo handlers.

- Wear safety shoes and helmets.
- Do not wear rings.
- Use the accommodation ladder or brow for boarding or leaving the ship.
- Use the ladders in the square of the hatch only when hoist is not in motion.
- Use the walkway on ship's side away from the side on which cargo is being worked.
- Secure all lashings to permanent deck fastenings. Never depend on movable objects lying on deck (dunnage, hatch covers, etc.).
- Secure hatch rollers properly.
- Lower blocks, crowbars, slings, bridles, and other objects into the hold by cargo falls or other lines. Do not drop or throw.

- Stack hatch covers in an orderly manner. Disorderly piles create tripping and stumbling hazards.
- Lay strong backs flat to prevent tipping over.
- When removing or repairing strongbacks, keep them between you and the open hatch.
- Stand in the clear away from suspended loads,
- When steadying loads, always fire them and keep your feet in the clear.
- Stand clear of slings being pulled from under loads.
- Stand clear when strongbacks and hatch covers are handled on the deck above.
- Be particularly careful when handling objects with sharp or rough edges.
- Learn and practice proper lifting techniques to prevent strains and sprains.
- Never walk backward.
- Step down from elevations, do not jump.
- Report all defects in tools, materials, and equipment.
- Report all injuries, however slight, and get immediate first aid or medical attention.
- Do not smoke in holds or storerooms.
- Learn the location of fire alarm boxes and firefighting equipment.
- Do not engage in horseplay, practical jokes, or arguments while working cargo.

